

Appendix C

MASTER DRILLING PLAN (MDP) RED RIM PLAN OF DEVELOPMENT (POD)

OPERATORS (The Companies):

Warren E & P, Inc. (Warren)

Anadarko E & P Company (Anadarko)

Sections 20 & 28 in T20N R89W, 6th PM, Carbon County, Wyoming

BLM Leases: WYW149261, WYW150410

Drilling Plan for the subject wells listed below:

Gas Wells in Section 20

AR Federal 2089 NE20 (WYW149261)

AR Federal 2089 SE20 (WYW149261)

AR Federal 2089 SW20 (WYW149261)

Gas Wells in Section 28

AR Federal 2089 NW28 (WYW150410)

AR Federal 2089 NE28 (WYW150410)

Monitoring Well

BLM has requested that three to six groundwater monitoring wells be installed within the Atlantic Rim EIS study area during the interim drilling project. The locations of these monitoring wells have not yet been specified, however, one of them will be located in the Red Rim project area. The effects of interim drilling and development on the coal aquifer, including drawdown, will be monitored by these wells.

1. ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS

Formation	Depth
Lance	Surface
Lewis Shale	630' – 2460'
Almond	2880' – 4710'
Pine Ridge SS	3420' – 5250'
Allen Ridge	3560' – 5390'
TD (Gas Wells)	4050' – 5850'
Hatfield/Cherokee/Deep Creek	5965' – 6335'

2. ESTIMATED DEPTH OF ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS

Almond	Natural gas
Pine Ridge	Natural gas
Allen Ridge	Natural gas

The Lance Formation and Lewis Shale are not anticipated to contain any zones capable of producing water. There are several zones within the Mesaverde Group capable of producing fresh water, including the coal seams. The Companies propose to test the productive formations between 2,880' and 5,390'. Several coal seams may be tested for gas production to total depth. All shallow water zones will be protected with casing and cement. Cement will be brought above the base of the Lewis Shale to isolate all formations in the Mesaverde Group.

Planned Objective for Gas Wells: Mesaverde

3. MINIMUM BLOW OUT PREVENTOR (BOP) REQUIREMENTS (refer to attached schematics)

1. The BOPE will conform to Onshore Shore Order #2. The blowout preventer equipment will consist of a 2000 psi W.P. Double Ram, Hydraulic Preventer (enclosed). All fill and kill lines will be 2000 psi W.P. From 0-160' there will be no pressure control. From 160'-1,600' the 2,000# system will provide control. Note: These wells are proposed as coal bed natural gas (CBNG) wells. Data from a number of CBNG wells drilled in the area indicate that the maximum anticipated surface pressure will not exceed 250 psi, thus the BOP will be tested to 1,000 psi (see attached schematic).
2. The BOP shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
3. The Companies shall notify the Rawlins BLM office 24 hours prior to the BOP test.

4. SUPPLEMENTAL INFORMATION

The primary objective of this project is to drill, stimulate, and produce natural gas from coal seams in recognized gas-producing formations of the Mesaverde Group. The coal seams are overpressured and are very unlikely to be in communication with overlying layers. Produced water will be conditioned and discharged as authorized by WDEQ in a NPDES permit or injected in one of two deep injection wells completed in the Cherokee/Deep Creek Sandstones. The coal seams will be perforated and stimulated by hydraulic enhancement or fracturing during testing. Fresh water, gelled water, and/or foam fracturing techniques will be used.

The following schematics that show typical facilities, operating standards, and methodologies, are attached to this MDP: [B.O.P.](#); [Bottom Flange](#); [Configuration Options](#); [Completed Well](#); and [Injection Well](#). Additional schematics for this POD are attached to the [Master Surface Use Program \(MSUP\)](#): [Drill Site Layout](#); [Well Site](#); [Water Disposal Facility](#); [Water Transfer Facility](#); [Water Conditioning Facility](#); and [Compressor Station](#).

5. CASING PROGRAM

<u>Hole Size</u>	<u>Casing Size</u>	<u>Casing Wt.</u>	<u>Grade</u>	<u>Joint</u>	<u>Depth Set</u>	<u>New/Used</u>	<u>Rng</u>
12 ¼"	9 "	32.3#	H-40	ST&C	10% of well depth	New	3
9 "	7"	23#	MC-50	LT&C	0-TD	New	3
Surface Casing:							
	9 "	32.3 ppf	H-40	STC	Collapse	Burst	Tension
				Ratings:	1370	2270	254M

A. $\text{Burst} = [0.052 * \text{FG} * \text{TVD (shoe)}] - [\text{Gas Gradient} * \text{TVD}]$
 $= [0.052 * 8.8\text{ppg} * 580'] - [0.1\text{psi/ft} * 580']$
 $= 207.4\text{psi}$
 $\text{Safety Factor} = \text{Rating/Burst}$
 $= 2270/207.4$
 $= 10.94$

B. $\text{Collapse} = 0.052 * \text{MW} * \text{TVD (shoe)}$
 $= 0.052 * 8.8\text{ppg} * 580'$
 $= 265.4\text{psi}$
 $\text{Safety Factor} = \text{Rating/Collapse}$
 $= 1370/265.4$
 $= 5.16$

C. $\text{Tension} = \text{Weight} * \text{MD} * [1 - (\text{MW}/65.5\text{ppg})]$
 $= 32.3\text{ppf} * 580' * [1 - (8.8\text{ppg}/65.5\text{ppg})]$
 $= 16299 \text{ lbs.}$
 $\text{Safety Factor} = \text{Rating/Tension}$
 $= 254,000/16299$
 $= 15.58$

Surface casing shall have centralizers on the bottom 3 joints of the casing, starting with the shoe joint.

Production Casing:	7"	23 ppf	MC-50	STC	Collapse	Burst	Tension
				Ratings:	3110	3960	273M

$$\begin{aligned}\text{A. Burst} &= [0.052 * 8.3\text{ppg} * 5800'] - [0.1\text{psi/ft} * 5800'] \\ &= 1923.3\text{psi} \\ \text{Safety Factor} &= \text{Rating/Burst} \\ &= 3960/1923.3 \\ &= 2.06\end{aligned}$$

$$\begin{aligned}\text{B. Collapse} &= 0.052 * 8.3\text{ppg} * 5800' \\ &= 2503.3\text{psi} \\ \text{Safety Factor} &= \text{Rating/Collapse} \\ &= 3110/2503.3 \\ &= 1.24\end{aligned}$$

$$\begin{aligned}\text{C. Tension} &= 23\text{ppf} * 5800' * [1 - (8.3\text{ppg}/65.5\text{ppg})] \\ &= 23\text{ppf} * 5800' * .87 \\ &= 116,058 \text{ lbs.} \\ \text{Safety Factor} &= \text{Rating/Tension} \\ &= 273,000/116,058 \\ &= 2.35\end{aligned}$$

6. MUD PROGRAM

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.3–10 ppg. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

7. CEMENTING PROGRAM

The following is the proposed procedure for cementing the 9" surface pipe and 7" long string:

Surface Casing:

Lead: Class "C" Type III, 14.4 ppg, yield 1.44ft³/sk @ 101% excess. Compressive strength in 24 hours at 80°F 3100psi.

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

Long String:

Lead: Class "C" Type III, 14.4 ppg, yield 1.44ft³/sk @ 35% excess. Compressive strength in 24 hours at 95°F 3200psi.

Estimated top of cement back to surface.

8. LOGGING PROGRAM

Cores: Rotary Cores will be taken as needed to evaluate the coal seams.

DSTs: None Planned

Logs: Induction, GR, SP, Density, Neutron and Caliper – From surface to TD
Cement Bond Log – From 9" casing shoe to TD
Mud Logger – As needed.

9. PRESSURE DATA AND POTENTIAL HAZARDS

Bottom hole pressures anticipated at much less than 1,000 – 1,100 psi.
There is no history of hydrogen sulfide gas in the area and none is anticipated.

10. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS

A. Anticipated Starting Dates:

Anticipated Commencement Date	- Fall 2003, or upon approval
Drilling	- Approximately 7 days per well
Completion	- Approximately 2 days per well
Initial Testing	- Approximately 7-14 days per well
Production Testing	- Approximately 6-12 months per well

Note: Drilling operations will commence as soon as practical after approval of all necessary permits including the Applications for Permits to Drill (APDs).

B. Notification of Operations:

Rawlins Field Office, BLM
1300 North Third St.
Rawlins, Wyoming 82301
(307) 328-4200